Distributional effects of climate policies

Kerkhof, Annemarie Charlotte

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7. General conclusions and final remarks

7.1. Introduction

Concerns about inequitable distributions of burdens are a serious barrier for the implementation of climate policies (IPCC, 2001; OECD, 1995, 2006; EEA, 2006). Therefore, this thesis aims at examining the possible distributional effects of climate policies among and within European countries. The majority of studies in this thesis used a combination of life-cycle based methods and consumer survey statistics to explore the distributional effects of climate policies among households in a number of European countries. The Gains model enabled an exploration of the distributional effects of a uniform European climate policy among European countries. This chapter starts with a discussion on some aspects that may have influenced the results of this thesis (Section 7.2). Then general conclusions are drawn regarding household GHG emissions in different income groups (Section 7.3), the valuation of environmental public goods at different spatial scales (Section 7.4), and the distributional effects of climate policies (Section 7.5). Finally, policy recommendations are formulated (Section 7.6) and some directions for further research are indicated (Section 7.7).

7.2. Discussion of results

The analyses in Chapter 2, 3 and 5 are (partly) based on input–output analysis, which has both its strengths and weaknesses. The combination of environmentally extended IOA and consumer survey statistics enables a fast exploration of the complete consumption pattern of households and the associated GHG emissions. However, IOA is restricted to fixed input-output coefficients and to exogenously-determined final demand. In the long-term, however, producers and consumers will adjust their behavior to the changed product prices. Producers will use different inputs in their production processes and consumers will adjust their consumption patterns. These changes will eventually affect the product prices and the distribution of costs of climate policies. Accordingly, the results of Chapter 2, 3 and 5 should be considered as short-term approximations of the distributional effects of climate policies.

In the input-output analyses, imports are assumed to be produced with domestic technologies. In other words, GHG emission intensities of imports are assumed to be equal to the GHG emission intensities of similar domestic products. Recent studies using multi-region, multi-sector input-output models demonstrated the importance of explicitly taking into account the production technologies and emissions of imports (Peters and Hertwich, 2006; Wiedmann et al., 2007). Consequently, it is recognized that this assumption has influenced the GHG emission intensities of certain product groups in this thesis. The ultimate effect on the distributional effects of climate policies also depends on the specific consumption patterns of households in different income groups, and is, therefore, not simply to evaluate.

7.3. Household GHG emissions in different income groups

The first research question in section 1.4 has been formulated as follows: "What is the variation in household GHG emissions among income groups and what is the relative importance of different final consumption categories?". This research question has been explored in Chapter 2 and 3, which quantify the household GHG emissions in different income groups in the Netherlands, the UK, Sweden and Norway. The results of these chapters demonstrate that the variation in household GHG emissions among income groups largely depends on both the household consumption level and pattern in different income groups and the GHG emission intensities of basic and luxury goods.

The environmentally extended input-output analysis in Chapter 2 shows that GHG emissions (including CO_2, CH_4 and N_2O) increase with increasing household expenditures in the Netherlands. However, GHG emissions increase less than proportionally with expenditures. This implies that the GHG emission intensity of household consumption decreases with increasing expenditures, indicating that the consumption patterns shift to less emission-intensive products. The results show that GHG emissions from Dutch households are mainly related to the consumption of the product groups 'food', 'house' and 'development, leisure and traffic'. With increasing expenditures, the share of the expenditures on the basic commodities 'food' and 'house' decreases, while the share of expenditures on the luxury good 'development, leisure and traffic' increases. Since 'food' and 'house' have higher GHG emission intensities than 'development, leisure and traffic', the total GHG emission intensity of household consumption decreases with increasing expenditures. Similar results are found with the hybrid analysis in Chapter 3. This analysis shows that the CO_2 emission intensity of Dutch household consumption decreases with increasing disposable income.

Chapter 3 considers the CO_2 emissions of households in a number of European countries, enabling a regional comparison. The study shows that average households in the Netherlands and UK give rise to higher amounts of CO_2 emissions than households in Sweden and Norway. The variation in average household CO_2 emissions can be largely ascribed to the differences in CO_2 emissions from housing, which is largely the result of the CO_2 emission intensities of national energy supply. Sweden and Norway have energy sources with low CO_2 emission intensities, such as hydro-electric power, while the Netherlands and the UK mainly have energy sources with higher CO_2 emission intensities like fossil fuels. However, this effect is partially offset by the CO_2 emissions from transport. Sweden and Norway have lower population densities than the Netherlands and the UK, resulting in higher household expenditures on transport. As a consequence, Swedish and Norwegian households have higher CO_2 emissions from transport than households in the Netherlands and the UK.

Additionally, Chapter 3 provides insight into the household CO_2 emissions in different income groups for the four North-West European countries. CO_2 emission intensities of household consumption decrease with increasing income in the Netherlands and the UK, whereas they increase in Sweden and Norway. The CO_2 emission-intensive energy supply in the Netherlands and the UK lead to high CO_2 emissions from housing (mainly home heating and electricity). Since housing is a basic commodity, low-income households spend a larger share of their expenditures on housing than high-income households, resulting in a more CO_2 emission-intensive consumption pattern for low-income households than high-income households. Accordingly, the availability of energy sources with low CO_2 emission intensities in Sweden and Norway leads to a more equal distribution of total household CO_2 emissions across income groups. In Sweden, district heating is an additional factor contributing to the equal distribution of CO_2 emissions among income groups.

A country's population density also influences the distribution of household CO_2 emissions across income groups. The low population densities in Sweden and Norway result in high CO_2 emissions from transport. Since the share of expenditures on transport increases with income, high-income households have more CO_2 emission-intensive consumption patterns than low-income households in Sweden and Norway. Accordingly, the high population densities in the Netherlands and the UK lead to a lower influence of transport on the distribution of household CO_2 emissions, and therefore high-income households have in total less emission-intensive consumption patterns than low-income households.

7.4. Emission price

Economic instruments, such as emission trading and taxation, assign a price to GHG emissions. This emission price may change both the prices of inputs of production processes and the prices of consumer products. Such price changes will influence the purchasing behavior of producers and consumers, ultimately leading to the reduction of GHG emissions. Setting an appropriate emission price is not simply to accomplish. It depends both on the level of environmental quality that people prefer and the costs that are related to the achievement of such an environmental quality. The valuation literature was reviewed in Chapter 4 in search of a suitable price for GHG emissions.

From the review study, it appears that conventional valuation methods as the contingent valuation method, hedonic pricing method and travel cost method have been mainly applied to the local and landscape scale. However, the number of case studies on the regional and global scale has been increasing in recent years, which could be a reflection of an increased awareness of environmental impacts at high spatial scales. The few studies that estimate the willingness-to-pay (WTP) for climate change mitigation could provide a starting-point for determining a price for GHG emissions. However, this thesis handles such values with some caution. In Chapter 4, it is argued that a change in scale may have consequences for the applicability of conventional valuation methods.

Chapter 4 describes some aspects that may influence the applicability of conventional valuation methods at high spatial scales. First, the analogy between private and environmental public goods is more and more burdened with increasing spatial scales. Second, individuals may be less acquainted with changes in environmental public goods at high spatial scales. Third, uncertainties in environmental changes at high spatial scales may influence the valuation process, because the environmental change itself is not well-defined yet. Fourth, in the case of climate change, the spatial heterogeneity of the impacts will probably lead to multiple values for climate change mitigation. Although, the design of a valuation study can be adjusted in order to diminish some of the difficulties related to the valuation of environmental changes at high spatial scales, it is yet unclear at what range of spatial scales valuation methods can be applied to yield valid results.

To be able to investigate the cost distribution of economic instruments across households and countries, emission prices for GHG were derived from the marginal costs of emission reduction measures needed to achieve a given emission reduction target. Although, this approach may not lead to an optimal economic welfare, it is more feasible in practice and represents a least-cost method of realizing policy objectives (Baumol and Oates, 1971). This method is adequate for the research in this thesis, which focuses on distributional effects.

7.5. Distributional effects of climate policies

The aim of this thesis is reflected in the second and third research question in section 1.4: "How will the costs of climate policies, such as GHG taxation, be distributed across households in different income groups?" and "How will the costs of a uniform European climate policy be distributed across European countries?". The first part of the thesis (Chapter 2 and 3) provides insight into the variation in household GHG emissions among income groups, which may have important implications for the distributional effects of climate policies. The second part of the thesis explores the distribution of costs of economic instruments in the Netherlands (Chapter 4) and in the EU27 (Chapter 6).

Chapter 2 shows that GHG emissions increase less than proportionally with increasing expenditures in the Netherlands, implying that the GHG emission intensity decreases with increasing expenditures. This indicates that costs of climate policies may distribute regressively, i.e. low-income households experience a relatively higher burden than high-income households. This is confirmed by the analysis in Chapter 5, which shows that low-income households spend a greater share of their income on either a CO_2 tax or a GHG tax (covering all six Kyoto gases) than high-income households in the Netherlands. Chapter 5 also reveals that a CO_2 tax and a comprehensive GHG tax are regressive to a different extent. A GHG tax seems to distribute the tax burden more equally across income groups than a CO_2 tax. This can be largely explained by two factors. First, extending the scope of taxation from CO_2 to all six gases of the Kyoto protocol shifts the tax burden from energy-intensive products to food products. Second, the expenditures on energy-intensive products and food products differ across income groups. Low-income households spend a slightly greater share of their income on food than high-income households, however, this difference is smaller than the difference with respect to the gas and electricity.

The results of Chapter 3 may indicate possible distributional implications of climate policies among and within four North-West European countries. In the Netherlands and the UK, the consumption patterns of low-income households have higher CO_2 emission intensities, and may therefore carry a relatively higher burden of climate policies, than high-income households. The opposite holds for households in Sweden and Norway, where the consumption patterns of high-income households have higher CO_2 emission intensities than low-income households. Additionally, households in the Netherlands and the UK have higher CO_2 emissions and CO_2 emission intensities than households in Sweden and Norway. Therefore, households in the Netherlands and the UK may carry a higher burden than households in Sweden and Norway in the case of a uniform European climate policy.

The analysis with the Gains-model in Chapter 6 also provides insight into the distribution of costs of a uniform European climate policy among European Member States. The results of the Gains model, however, cannot be compared with the results of the hybrid method in Chapter 3. In Chapter 3 (as well as in Chapter 2 and 5), it is assumed that the costs of climate policies will be distributed across households proportional to the amount of

GHG emissions of those households. With the Gains-model, the costs of climate policies are distributed across countries according to the mitigation opportunities in those countries. By equalizing marginal abatement costs across countries, the Gains-model selects the cost-optimal mitigation measures for achieving a given target in Europe in 2020.

In Chapter 6, the distribution of costs across European Member States is examined in the case of a 10 percent reduction of total GHG emissions in the EU27 in 2020 as compared to the baseline (including current air pollution legislation) in 2020. The same absolute amount of GHG emissions is reduced in both a Multigas strategy (including CO_2, CH_4 and N_2O) and a CO_2-only strategy. The results show that both strategies will lead to a regressive distribution of climate change mitigation costs across European Member States. This means that countries with a relatively low GDP (Eastern European countries) spend a larger fraction of their GDP on climate change mitigation costs than those with a relatively high GDP (Western European countries). A Multigas strategy leads to a more uneven distribution of mitigation costs across countries than a CO_2-only strategy. In the Multigas strategy, all European countries implement inexpensive non-CO_2 GHG abatement measures. These inexpensive abatement measures make the implementation of expensive CO_2 measures unnecessary. So, expensive CO_2 measures of Western Europe are no longer implemented and as a result the Western European countries experience a decrease in mitigation costs. However, the relatively cheap CO_2 mitigation measures in Eastern Europe are still cost-effective to be implemented for achievement of the reduction target. So, Eastern European countries still implement their CO_2 measures in a Multigas strategy and on top of that they implement non-CO_2 GHG measures, resulting in higher total mitigation costs.

7.6. Policy recommendations

Insight into the distributional effects of climate policies among and within countries helps policy-makers to anticipate distributional effects and, as a consequence, to enhance the acceptability of climate policies. For the Dutch situation, this thesis demonstrates that extending the scope of taxation from CO_2 emissions to all six Kyoto gases would lead to a more even distribution of the tax burden across income groups. To further enhance the social acceptability of a comprehensive GHG tax, it is recommended to adapt the design of the tax in such a way that the regressive effects are diminished. A tax-free GHG emission allowance can be introduced for gas and electricity to a certain level, reducing the impact on the purchasing power of lower income groups in particular. Moreover, revenue-cycling can be designed in such a way that low-income households are spared. Another option is to reduce the GHG emissions of low income-households by providing subsidies for home insulation, or by providing information on possibilities to reduce household GHG emissions, e.g. by adjusting consumption patterns.

Climate policies may have regressive effects in the UK as well. These regressive effects can be mitigated by the design of the climate policies, e.g. by directing the policies to GHG emission-intensive luxuries, such as transport, rather than on GHG emission-intensive necessities, such as home heating or electricity. In contrast, climate policies may have slightly progressive effects in Sweden and Norway. It is therefore conceivable that the distributional effects of climate policies are of less importance for the acceptance of climate policies in those countries.

This thesis also shows that households in the Netherlands and the UK may carry a higher burden than households in Sweden and Norway in the case of a uniform European climate policy. The research shows that differences in country characteristics, such as energy supply, the availability of district heating and population density, influence the variation in household CO_2 emissions among and within the Netherlands, UK, Sweden and Norway. Therefore, it is recommended to take into account country characteristics when addressing the equity of European climate policies. Different GHG emission reduction targets for the four North-West European countries can lead to a more even distribution of costs for households.

A cost-effective climate policy will lead to a regressive distribution of climate change mitigation costs across European Member States, which in general means that Eastern European countries spend a larger fraction of their GDP on climate change mitigation costs than Western European countries. Extending a CO_2-only strategy with non-CO_2 GHG may even intensify this regressive effect. Policy-makers can diminish the increase in inequity between Western and Eastern Europe by distributing emission permits according to other allocation rules than by equalizing marginal abatement costs. Application of allocation rules that converge the total mitigation costs as share of GDP for Western and Eastern Europe can create benefits for Eastern European countries. In that case, Eastern European countries can sell their emission rights to Western European countries. Then, a Multigas strategy would be even more beneficial to Eastern Europe than a CO_2-only strategy.

7.7. Further research

In this thesis, the distributional effects of climate policies are analyzed at different spatial scales, including the country level and the European level. Unfortunately, it was not possible to apply the same method at the different spatial scales, because no (environmentally extended) IO-table was available for Europe. This hampers a comparison of the results. A detailed environmentally extended IO-table is being developed for the EU25 in the EXIOPOL project. EXIOPOL is an integrated project funded by the European Commission under the 6th framework program, which runs from 2007 to 2010[25]. This IO-table will offer opportunities for examining the distributional effects of climate policies among households in the EU25. This may provide a more complete picture of the cost distribution of climate policies in European countries and the EU25.

Additionally, in the input-output analyses in this thesis, imports are assumed to be produced with domestic technologies. In other words, GHG emission intensities of imports are assumed to be equal to the GHG emission intensities of similar domestic products. In the EXIOPOL project the environmentally extended IO-tables of EU countries and other countries/world regions will be linked via trade. With such an approach foreign production technologies and related emissions can be taken into account when examining the GHG emissions of imports.

[25] For more information on the EXIOPOL project see www.feem-project.net/exiopol.